E/CONF.39/D/15
26 Sept.1962
ORIGINAL : ENGLISH

UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

Agenda Item: D.5.1

India

INDUSTRIAL DEVELOPMENT-PULP AND PAPER

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Agenda item: D: INDUSTRIAL DEVELOPMENT

D.5.1: Pulp and Paper

(By A. Seetharamiah and N. Narasimhan)

INTRODUCTION

1. Paper is one of the basic needs of modern life. It is the most vital vehicle for propagation of education. The progress of literacy, education, social service and industries during the last few years has already led to an unprecendented increase in demand for paper in the country. This trend is likely to get intensified in the coming years. The consumption of paper and boards including newsprint, in 1961-62 was 560,000 tons against 209,000 tons in 1950-51.

EARLY HISTORY

2. The beginning of the paper industry in India dates back to 1832 when the first paper machine was established at Serampore in West Bengal. The industry which even in the early stages was conscious of the limitations and handicaps under which it was working due to the necessity of using imported pulp, took early advantage of the researches carried out at the Forest Research Institute, Dehra Dun, which established the use of bamboo as a raw material for manufacture of paper. The paper industry had to struggle hard for its existence during the early period due to stiff competition from cheap imported paper and some units had to close down. In order to protect the indigenous bamboo based paper industry, a protective duty was levied in 1925 on imported papers. This created the requisite atmosphere for the growth of paper industry in the country and the restricted availability of imported paper due to the Second World War gave a further fillip to its stabilisation and expansion. Since then the paper industry has never looked back and it has maintained a steady progress.

3. The annual production of paper and paper boards excluding newsprint in 1937 was 48,228 tons. This rose to 93,090 tons in 1947 when the protective duty was removed. The rate of increase has been well maintained and the production which was 131,915 tons in 1951 when Industrial Development in the country was taken up on a planned basis rose to 193,400 tons in 1956 and 364,118 tons in 1961. However, the per capita consumption of paper is still very low averaging about 1 kilo/year as compared to more than 200 kilos/year in U.S.A. and 50 to 100 kilos in European countries.

PRESENT POSITION OF THE INDUSTRY

4. At present there are 30 mills manufacturing paper and paper boards with a total installed capacity of 433,800 tons. Most of the existing paper mills are integrated units which manufacture pulp for conversion to paper. There is at present no unit producing only pulp. In addition, there are 27 units manufacturing millboards and strawboards with a total capacity of 82,400 tons. One unit with a capacity of 30,000 tons/year has been established for the manufacture of newsprint from Salai (Boswellia Serratta) a tropical hard wood in admixture with chemical pulp from bamboo. The total investment in the industry is at present of the order of Rs. 40 crores and the industry provides direct employment to 34,000 persons.

5. The existing paper mills are manufacturing almost all the common varieties of writing, printing and packing papers and boards excluding certain special types of papers such as Manila paper, condenser and cable and other electrical insulation papers, photographic base paper, carbonising tissues, glassine and vegetable parchment paper, high strength kraft paper for multi-wall bags, kraft-liner, foil paper and ivory boards which are not manufactured in the country. Steps have been taken to establish production of most of these types of papers in the next few years.

FUTURE PLAN FOR DEVELOPMENT

6. The following targets of production have been fixed for 1965-66:-

Paper & Paper Boards	-	700,000 tons/year
Newsprint	-	150,000 tons/year
Dissolving Pulp	-	100,000 tons/year

The present installed capacity for paper and paper boards is 433,800 tons/year. Additional capacity of 769,840 tons/year has been licensed. Of this 155,560 tons/year is for expansion of existing mills and 614,280 tons/year for installation of 82 new units. Table 1 summarises the present position of licensing of capacity for paper and paper boards.

7. Newsprint production in the country is at present confined to one mill with a capacity of 30,000 tons/year. The question of doubling the capacity of this mill is now under consideration. Three more licences have been issued for establishment of new newsprint mills, two with a capacity of 60,000 tons/year each and the third with a capacity of 30,000 tons/year. Two of these schemes envisage the production of newsprint from bagasse with the admixture of imported chemical pulp in the initial stages (to be replaced by indigenous pulp in a few years). The third newsprint project is to be based on soft woods available in the Himalayan region. In the case of dissolving pulp, 7 schemes based on bamboo with a total capacity of 267,600 tons per year have been licensed, out of which 4 schemes with a capacity of 141,000 tons per year have been given approval for import of plant and machinery.

8. It is estimated that by 1980-81, the per capita consumption would increase to about 7 kilos. In order to meet this demand, the perspective planning is for the expansion of capacity on the following basis:

	Estimated Production in Million Tons				
	Paper & Paper Boards	Newsprint	Chemical Pulp	Total	Per capita consumption
1970/71	1.2	0.3	0.2	1.7	3.5
1975/76	2.0	0.45	0.4	2.85	5.0
1980/81	3.0	0.60	0.6	4.20	7.0

Realization of these targets poses problems of availability of raw materials, machinery and technical manpower.

9. (a) There is a considerable divergence of views about the economic size of a paper mill. In advanced countries, the trend is to have paper mills with as large a capacity as possible producing a limited varieties of paper. Newsprint mills are invariably very much larger than paper mills.

(b) The establishment of such large units takes a long time and also requires heavy investment on plant and machinery and provision of ancillary services like water supply, power supply, rail and road transport facilities etc. Furthermore, the economic success of such large mills depends on the availability of adequate supplies of raw

materials on a sustained basis within a relatively short distance. In the earlier stages mills with capacities of 25/30 tons per day were considered to be economic. With the development of road and rail transport systems and creation of facilities for manufacture of machinery in the country, the present trend is to establish mills with capacity of 100 tons/day and more. The older mills with lower capacities are also expanding to this level.

ROLE OF SMALL UNITS OF 5/10 TONS/DAY CAPACITY

10. Although it would be desirable to set up large pulp and paper mills under special circumstances there would be scope for setting up a limited number of smaller units also. Even now in Europe and Japan a number of small paper mills are in operation. Most of these units procure pulp from outside sources and produce special types of papers which do not lend themselves for manufacture on large fast running machines. In India too a few small paper mills with capacity of 5/10 tons/day have been in operation for a number of years.

11. The question of establishing small paper units with a capacity of 5 to 10 tons per day in different parts of the country has been engaging our attention for some time past. It was evident that there would be limited scope for such units, because they would have to depend on pulp from outside sources, as conventional pulping would not be practicable in such small units in view of high cost of production and difficulties in the disposal of effluents. It was envisaged that 5 to 10 tons/day paper units could make either speciality papers or ordinary grades of printing and writing papers or wrapping papers in the vicinity of large cities where auxiliary raw materials like waste paper and rags could be collected easily and where other services such as power, water and facilities for effluent disposal would be available. It is considered that there is scope for the development of such small units to a limited extent in the country side by side with large units. A number of such small units have been licensed and it is expected that during the course of this year 12 such new small units will commence production.

POSITION OF RAW MATERIALS

12. The Indian Sub-Continent is rich in forest wealth. But the resources of soft woods (which are the conventional raw materials for the manufacture of pulp and paper in the industrially advanced countries) are restricted to the higher reaches of the lower Himalayan region. Uptil now the problems connected with the extraction and transport of timber from high mountain forests and regeneration by natural and artificial means have not been satisfactorily solved in this country. Recently steps have been taken to study the feasibility of utilization of such timbers available in Punjab and in Jammu and Kashmir for manufacture of suitable types of pulp and paper, with the assistance of experts from Canada and USSR.

13. The country had, therefore, to look for other unconventional raw materials for the manufacture of pulp and paper. Bamboo which grows widely in many parts of the country and which has a felling cycle of only 3 to 4 years has, therefore, been the obvious choice of the paper makers in this country. At present bamboo comprises about 80% of all cellulosic raw materials used in the country for the manufacture of paper and paper boards. Sabai grass (Eliopsis Binata) which grows in the sub-Himalayan regions is used to a limited extent. In recent years attention has been paid towards the utilization of hard woods and agricultural residues. Salai (Boswellia Serratta) which grows in Central India is being utilized for the manufacture of newsprint and to a small extent for other types of papers and boards. Bagasse has been used as the main raw material for manufacture of strawboard for a number of years. In 1950 M/s Rohtas Industries Ltd., Dalmianagar established a plant for the manufacture of bleached pulp from bagasse adopting the Celedecor-Pomilio Process. This pulp is being used by them in admixture with bamboo

pulp in different grades of papers and paper boards. Other units are also using bagasse to a small extent for various grades of paper in admixture with bleached pulp from bamboo/grass. A number of bagasse based units are planned to be established in the country during the Third Five Year Plan. A statement showing the Fibre Characteristics and other related properties of different cellulosic raw materials is at Annexure I.

RAW MATERIALS FOR THE FUTURE DEVELOPMENT

14.(a) The existing resources appear to be inadequate for meeting the requirements for the expansion of the pulp and paper industries beyond 1965-66. The net quantity of bamboo which could be made available for pulp and paper manufacture is about 2 million tons per year, which will only yield about 0.8 million tons of paper. All known available resources of bamboo have been earmarked for paper and pulp schemes already licensed.

(b) The average yield of bamboo in the country is only about 1 ton per acre on a four year cycle. The leased areas exploited by paper mills, however, yield on an average upto 2 tons per acre. Even this is very much below the yield of 3.5 to 4 tons/acre claimed by other countries like Japan. This is presumably due to bamboo being cultivated as a crop whereas in India extraction is from natural forests. Therefore, steps are being taken to encourage the lease of forests direct to paper mills on a long terms basis and make the paper mills responsible for maintaining and developing these forests and also to exploit the forests on scientific basis.

15. Proposals are under consideration for a country-wide survey of the cellulosic resources and selection of ecologically favourable areas for plantation of suitable fast growing species and to launch on an intensive reafforestation programme. A start has been made on the plantation of Eucalyptus and Wattle in the Nilgiris in the Madras State and in Kerala State. Proposals are also under consideration for plantation of suitable species of eucalyptus and pine in other suitable parts of the country at the rate of 100,000 acres annually over the next 15 years. When this programme materialises about 4.5 million tons of pulpable timber could be expected to be made available to the paper industry. As bamboo normally grows as an under cover, the feasibility of growing bamboo alongwith other species of timber is also receiving consideration. These steps, however, even under the most favourable considerations are not likely to yield results before 1980 and in the meanwhile the further expansion of the industry has to be based on bagasse and other agricultural fibres.

16.(a) Based on an annual production of 3.2 million tons of sugar, the annual availability of bagasse on a bone dry basis is estimated at 3.75 million tons. This quantity would be sufficient to produce 1.5 million tons of paper annually if it could be made available for paper manufacture. Bagasse is, however, at present the main source of fuel available on the spot in the sugar mills. Some time back the Government suggested to all the sugar mills in the country to release bagasse for manufacture of paper by modifying their existing boilers for firing alternative fuel (coal/oil). The question of exempting levy of excise duty on furnace oil when used for replacement of bagasse is also under consider--ation in order to make the use of furnace oil economically attractive to the sugar mills.

(b) The two methods by which bagasse could be released for pulping are (1) improved thermal efficiency in the sugar mills; and (2) use of alternate fuel. The operation conditions in sugar mills vary from one area to another and release of bagasse by improve--ment of thermal efficiency may present serious difficulties and even then the quantity released might not be more than 40% of the total bagasse production. The use of alternate fuel under suitable conditions will release all the bagasse produced. In the context of the present difficult fuel supply position in the country, the former method has been recommended to the industry for immediate consideration. There are, other problems as the sugar mill operations are seasonal while paper mills work all round the year.

17. During the past decade there has been significant progress towards greater utilization of other agricultural fibres such as rice-straw, cereal straws, grasses and reeds. A considerable amount of technical information and experience has become available, and pulping techniques have been developed for converting most of these fibrous raw materials into pulp and by suitable admixture of these pulps it is now possible to manufacture a wide range of papers. The possibilities of harnessing the resources of such raw materials in this country in the coming years is receiving attention. A step has already been taken in this direction with the recent success in the utilization of jute sticks for the manufacture of paper.

18. The other raw material resources which are not harnessed adequately for paper manufacture are waste paper and rags. The utilization of waste paper in India is only 12% against 30% in other countries. It has been recognized that it is in the interest of the paper mills to organize collection of waste paper and rags on a systematic basis.

RESEARCH AND DEVELOPMENT

19. Because of the difficulties in harnessing conifers(such as fir, spruce and pine), that have been explained in the preceding paragraphs, the Indian Pulp and Paper Industry had to develop on unconventional indigenous raw materials which had not been utilised elsewhere. Research in the field of utilization of bamboo and sabai grass for the manufacture of pulp was initiated in the Forest Research Institute Dehra Dun in the early twenties. As a result of this the two-stage Sulphate Process for the pulping of bamboo was developed. This pulping process with slight adaptations is now widely adopted by all the paper mills in the country except one which adopts the Mg base acid sulphite process. All the Sulphate mills recover chemicals for reuse and the sulphite waste liquor is at present concentrated and used in road building.

20. In 1948-49, studies were taken up for the utilization of some of the tropical hard woods available in the country for manufacture of newsprint. Experiments carried out in the Forest Research Institute, Dehra Dun indicated that newsprint could be manufactured utilising ground wood pulp from Salai (Boswellia Serratta), and bleached kraft pulp from bamboo. This was further confirmed by the Research work undertaken in the USA and the first 100 tons/day mill for the manufacture of newsprint utilizing 65% of Salai Ground Wood Pulp and 35% bleached bamboo kraft pulp was established in the country in 1955. Considerable difficulties were experienced by this mill in the initial stages because of the new raw materials used and steps have been taken to resolve the difficulties. Recently the Dehra Dun Institute has taken up work regarding the utilization of "Palas" (BUTEA MONDSPERINA) which is another species of hard wood growing fairly abundantly in Central India for manufacture of newsprint. Results so far obtained are encouraging and work on pilot plant and semi-commercial production are to be undertaken shortly. Further expansion of the existing newsprint mill is to be based on the results of these studies. The Forest Research Institute in active collaboration with the State Forest Authorities are also considering the problems connected with the regeneration of Salai wood and "Palas".

21. The requirement of rayon grade pulp,which is now met wholly by imports, is of the order of 75,000 tons per year and this is likely to grow to 100,000 tons by end of 1965-66. Over the last few years efforts have, therefore, been made to take up production of rayon grade pulp within the country utilising indigenous raw materials. Here again the difficulties of getting soft woods made it imperative for the industry to look for other unconventional raw materials. The possibility of using bamboo and bagasse for rayon grade pulp manufacture has been studied. Initially considerable research work was done on the initiative of the Government of India in West Germany and Japan. A few years back two of the leading Indian manufacturers of rayon and staple fibre established suitable pilot plants for studying rayon grade pulp manufacture from indigenous raw materials. The work done in these pilot plants so far with the active assistance of overseas collaborators (especially the Japan Consulting Institute, Tokyo, The International Paper Co., U.S.A.,

and Rayonier (Inc.) U.S.A.) has proved the technical and economic feasibility of manufacture of dissolving grade pulp from bamboo. Encouraged by these results licences have been granted for the manufacture of rayon grade pulp as indicated in para 7. The first unit for rayon grade pulp with a capacity of 54,000 tons per year is expected to commence production during the later part of this year. The pulping process to be adopted in this mill has been developed in their own pilot plant. The work regarding manufacture of rayon grade pulp from bagasse is still continuing. Results obtained so far indicate that bagasse might be an equally, if not more suitable raw material, for rayon pulp.

22. Studies have also recently been undertaken regarding use of bagasse for newsprint manufacture by some of the leading newsprint mills in U.S.A., West Germany and Japan, on behalf of the Indian firms who have been licensed for the manufacture of newsprint. The work so far carried out has indicated that manufacture of newsprint with a high percentage of bagasse pulp furnish is technically feasible. The economics of production and establishment of optimum conditions for pulping and newsprint production on high speed machines are still being studied.

23. Besides some of these major developments, work is also being constantly carried on by several paper mills to increase the yield of pulp, recovery of chemicals and fuel efficiency.

24. The implementation of the development plans by the industry requires a large number of trained technical personnel. Most of the large paper mills have their own apprentice training schemes. The Forest Research Institute offers courses in Pulp and Paper Technology and also training in pilot plant and semi-commercial production. These facilities are being expanded to meet the increasing demand for trained personnel.

MANUFACTURE OF PLANT AND MACHINERY

25. Pulp and Paper is a capital intensive industry. An integrated 100 tons/day pulp and paper plant requires an investment of about Rs. 7/8 crores of which the foreign exchange requirement is approximately Rs. 5 crores. The annual expenditure on spare parts and consumable stores for maintenance of production of the industry alone amounts to over Rs. 4 crores. Import licences to the extent of Rs. 44 crores have already been granted for plant and machinery required for achieving the targets envisaged for 1965-66. The country cannot, however, afford such a continuous heavy drain of foreign exchange. Further growth of the industry would have to depend on indigenous machinery. It would facilitate the manufacture of plant and machinery in the country and the production of consumable stores and spares, if the sizes of the plants were standardized. After careful examination it was decided that plants to be fabricated in the country should have capacities of 10 tons/day and below, 50/60 tons/day, and 100 tons/day and above. As the manufacture of paper mill machinery is highly specialised and even in foreign countries there are only a few reputed manufacturers of this machinery, such fabrication is being undertaken in collaboration with some of the leading pulp and paper mill machinery manufacturers in U.S.A., U.K., Sweden, West Germany, France and Japan.

CONCLUSION

26. The paper industry in India has made significant progress during the last decade. There has been a four-fold increase in production since 1947 when the country became independent. The fulfilment of the targets of production for 1980-81 would enable India to become one of the leading paper manufacturing countries of the world. The achievement of these targets no doubt present very serious problems particularly about raw materials, machinery and equipment, technical manpower and capital resources. Concerted efforts are being made to tackle all these problems. It is expected that by 1980-81 the country besides being self-sufficient with regard to paper and paper products, would also be in a position to export sizeable quantities of these products at least to neighbouring countries.

TABLE - 1

(1) STATE	(2) Mills in operation		(3) Additional capacity licensed			(4) Total capacity licensed (2 + 3)
	No. of units.	Existing capacity (tons/year)	Expansion of existing units (tons/year)	New Units No.	New Units Capacity (tons/year)	(tons/year)
ASSAM	-	-	-	3	36,120	36,120
BENGAL	5	97,050	13,800	5	11,100	121,950
UTTAR PRADESH	2	26,400	-	10	126,180	152,580
BIHAR	1	60,000	37,500	5	27,300	124,800
ORISSA	2	72,000	6,000	2	21,000	99,000
PUNJAB	3	36,600	1,560	4	37,200	75,360
MADHYA PRADESH	1	5,400	-	8	111,900	117,300
GUJARAT	2	9,000	3,600	5	16,060	28,660
MAHARASHTRA	7	29,910	30,900	22	133,860	194,670
ANDHRA	2	39,000	26,400	1	1,500	66,900
MYSORE	4	49,800	32,800	5	38,600	121,300
KERALA	1	8,640	3,000	2	6,000	17,640
MADRAS	-	-	-	8	42,560	42,560
RAJASTHAN	-	-	-	1	1,800	1,800
HIMACHAL PRADESH	-	-	-	1	3,000	3,000
	30	433,800	155,560	82	614,280	1,203,640

Annexure - I

COMPARATIVE CHEMICAL COMPOSITION & PHYSICAL PROPERTIES OF WOOD AND OF COMMON NON-WOODY FIBRES

FIBRE	ASH	LIGNIN	PENTOSANS	CROSS & BEVAN CELLULOSE	ALPHA CELLULOSE	AVERAGE FIBRE (MICRONS)	
						LENGTH	DIA
RICE STRAW	14-20	12-14	23-25	46-49	28-36	1450	8.5
STRAWS (Others)	6-8	17-19	27-32	50-54	33-38	1100-1500	9-13
REEDS	3-6	18-22	28-32	52-58	33-43	1000-1800	8-20
BAGASSE	2	19-21	30-32	59-62	40-43	1700	20
WOODY FIBRES FROM STALKS WITH BAST FIBRES	2-3	23-37	15-22	40-48	31-33	200-300	10-11
BAST FIBRES FROM ABOVE (e.g. Linen)	1-2	1-6	2-6	70-80	60	20,000-25,000	16-22
LEAF FIBRES (Hemp)	0.6-1.2	7-10	17-24	70-80	53-64	6000-9000	16-18
BAMBOO	1-2	24-29	16-18	60-63	50	2700	14
CONIFERS	Below 1	26-34	7-14	53-62	40-45	2700-3600	32-43
DECIDUOUS WOODS	"	23-30	19-26	54-61	38-49	1000-1600	38-50

SOURCE: "Cellulose Pulp" by Julius Grant.

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